Journal of the Society of Arts.

FRIDAY, JULY 23, 1869.

Announcements by the Council.

EXAMINATIONS, 1870.

The Council have this year decided to remove from the Programme those subjects in which the Science and Art Department holds examinations, which, it appears, are now largely taken advantage of by the same class of persons (and very often by the same individuals) as those who sit at the Society's examinations. The following subjects will therefore not appear in the programme for 1870 :—

Algebra.	Light and Heat.
Geometry.	Chemistry.
Trigonometry.	Mining and Metallurgy.
Conic Sections.	Botany.
Navigation, &c.	Animal Physiology.
Principles of Mechanics.	Free-hand Drawing.
Practical Mechanics.	Practical Geometry.
Magnetism, Electricity, &c.	Mechanical Drawing.

The Metrical System will also be omitted.

The programme is now in preparation, and will include some further modifications in the system, but the above, being by far the most important, are announced at the earliest opportunity.

NATIONAL ELEMENTARY TRAINING AND EDUCATION.

At the instance of the Council of the Society of Arts, His Royal Highness Prince Arthur has graciously consented to review, at the Crystal Palace, Sydenham, on Friday, the 30th inst., at 4 p.m., the boys of the several district and other schools, in or near the metropolis, who are sytematically taught drilling as part of their education.

Invitations to take part in the proceedings have been forwarded to the School of the Royal Military Asylum, Chelsea (Duke of York's School), the Royal Naval School, Greenwich, and the principal district and other schools.

A programme of the proceedings will be duly advertised in the daily papers.

The attendance of Members of the Society is invited.

IMPROVED CABS.

The Council of the Society of Arts offer the following medals for improved hackney carriages specially suited to the metropolis :—

The Society's Gold Medal for the best and most convenient open hackney carriage for two persons.

The Society's Silver Medal for the second-best ditto.

The Society's Gold Medal for the best and most convenient closed hackney carriage for two persons.

The Society's Silver Medal for the second-best ditto.

The Society's Gold Medal for the best and most convenient hackney carriage for four persons, either open or closed, or both.

The Society's Silver Medal for the second-best ditto.

Lightness of construction, combined with adequate strength and durability, will be especially considered in making the awards.

The awards will be made after actual trials of the carriages extending over a certain period.

Communications describing the carriages must be sent to the Secretary of the Society of Arts before the 1st January, 1870, the carriages to be sent to a place hereafter to be appointed.

The Council also offer the Society's Silver Medal for the best instrument, to be affixed to a cab or other hackney carriage, for indicating the fare as between the passenger and the driver, whether by registering the distance travelled or otherwise, and which instrument shall also indicate, for the convenience of the cab-owner and of the driver, the total distance travelled during the day and the total amount earned. The instruments competing, with full descriptions of their construction, to be sent to the Society's House before the 1st January, 1870.

Competitors may, at their option, sign their communications, or may forward with them sealed letters containing the name and address of the writer.

The Council reserve to themselves the right of withholding all or any of the medals, in case none of the carriages or instruments possess, in their opinion, sufficient merit.

SUBSCRIPTIONS.

The Midsummer subscriptions are due, and should be forwarded by cheque or Post-office order, crossed "Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

Proceedings of the Society.

MUSICAL PITCH.

In the month of January last, the following letter was addressed to the Earl of Clarendon :—

21st January, 1869.

MY LORD,—The Council of the Society of Arts have had under their consideration the question of a standard musical pitch for this country, and how far it may be possible to arrive at unformity in this matter with Continental nations.

The Council are desirous of ascertaining how far unanimity does exist abroad, and of obtaining information in reference to the pitch in use in the various countries named below, and I am directed to ask if her Majesty's government would aid the Council in their inquiry by procuring, through her Majesty's representatives abroad, from the several governments and

other accredited sources, replies to the queries appended to this letter.

I have the honour to be, My Lord,
Your Lordship's most obedient Servant,
P. LE NEVE FOSTER, *Secretary.*

The Right Hon. the Earl of Clarendon,
Her Majesty's Secretary of State for Foreign Affairs.

QUERIES.

1. Is there any standard musical pitch officially prescribed and in use, and if so, what is it, and by what number of vibrations for C is it represented? (It would be very desirable that a tuning-fork or other instrument showing the pitch should be procured and sent. The expenses of this the Society will pay.)
2. By what authority is it adopted, and how enforced?
3. Is it compulsory on any and what class of musicians, and whether or not in military bands, conservatoires, operas, royal chapels, &c.? Name these if any.

LIST OF PLACES WHERE IT IS DESIRED TO OBTAIN THE INFORMATION.

Berlin.	Naples.
Munich.	Milan.
Stuttgart.	Turin.
Vienna.	Bologna.
Leipsic.	Venice.
Cologne.	St. Petersburg.
Dresden.	Moscow.
Brussels.	Stockholm.
Florence.	Copenhagen.

Copies in French and German were prepared for distribution by the Foreign Office, who kindly undertook to make the inquiries.

The following replies have been received:—

COPENHAGEN.

Although the questions of the Society of Arts might almost be answered by a simple negative, I shall perhaps do well to state the Copenhagen practice as to musical pitch.

1. The band of the Royal Theatre (opera-house) tunes, in the beginning of the performance only, from a pianoforte in the orchestra. This piano is kept at pitch from two old forks (date not precisely known), which happen nearly to agree with the new French normal diapason, giving probably three or four more vibrations per second.
2. The A of the military bands is at least ¼ tone higher than that of the theatre. Their forks are (or are supposed to be) of uniform pitch.
3. The brass of the chief orchestral societies, local concerts, and small theatres, being supplied from the military bands, the pitch of the latter is the standard for such institutions.
4. The School of Music has the pitch of the Royal Theatre.
5. The above statements as to height of pitch rest on the authority of the tuner of the Royal Theatre.

G. STRACHEY.

Copenhagen, February 24th, 1869.

LEIPSIC.

1. There is no standard musical pitch officially prescribed or in use at Leipsic, but the pitch in common use is very high—that of the Gewand-haus concerts being represented by 920 to 940 vibrations for A (La).
2. The above-named pitch at Leipsic is in use at the Gewand-haus and Euterpe (concerts), and in the town theatre. The authority for its use is merely custom.
3. The pitch compulsory for military bands at Leipsic is that which has been made compulsory at Dresden.

At a conference of professional men, held in September, 1862, at Dresden, it was resolved that the French *diapason normal*, of 870 vibrations for A (La), as contradistinguished from the Vienna pitch of 932 vibrations for A, should be adopted. But it was found on subsequent trials and comparison between the *diapason normal* of the Académie Française and the Dresden pitch, that the latter was so very little higher (A = 892) that it was not worth while to alter it, the alteration involving a renewal of the then supply of brass instruments. Military bands, therefore, here, as in other parts of Saxony, use the Dresden pitch.

It is necessary to bear in mind that, though the pitch of 892 at Dresden has been compulsory at the court theatre and concerts, and in all Saxon military bands since 1866, it is not otherwise enforced—indeed, there is no authority to enforce it. In the Catholic church at Dresden the old pitch of A = 855, which is very like that of Mozart (A = 850), is still in use, and at the court theatre when certain operas of Gluck and Mozart are played the Mozart pitch is taken, there being a supply of brass instruments of that pitch.

J. A. CROWE, *Consul-General.*

P.S.—Inclosed are two forks—the Leipsic pitch and the Dresden pitch.

Leipsic, March 27th, 1869.

MUNICH.

(Translation.)

In answer to the note from Sir H. Haward, of February 19th of the present year, the undersigned has the honour to communicate the following information to Her Britannic Majesty's Chargé d'Affaires, Mr. Fenton, respecting the standard musical pitch prescribed in Bavaria.

There is in Bavaria an officially established pitch for music and musical instruments, which has been universally adopted since the month of January 1868. This is the same as the French pitch, based on the principle of the "Diapason Uniforme," which was introduced into France by a decree dated February 16th, 1859. The French diapason (tuning-fork) sounds the note A, the sixth tone of the French scale (*gamme*), which consists of seven tones, and the note A is represented by 870 vibrations per second. This tone, A (French "La"), is the note adopted as the standard tone for the tuning of instruments, the tone C (French "Ut"), the first tone of the French scale, not being used for this purpose. The standard pitch in Bavaria is prescribed by authority of the Royal Musical Intendance (Kœniglich Hofmusik Intendanz), and its general use has been thereby secured, so that only such tuningforks are allowed to be used in Bavaria as have been approved and stamped by the above-mentioned Intendance. All establishments for instruction and education in Bavaria, in which musical studies are pursued, have been apprised thereof by means of an ordinance of the Ministry under whose authority they are placed, and the directors of these establishments are made specially responsible for the exact observance of that ordinance.

The undersigned takes the opportunity of calling Mr. Fenton's attention to the "Official Gazette for Church and School Affairs," of January 14th of last year, herewith enclosed, which contains the ordinance (above referred to) for "The Introduction of the French Orchestral Pitch." The use of the standard pitch is obligatory on all classes of professional musicians in Bavaria who are in connection with the Ministry of the Interior for church and school affairs, and in accordance with a communication made in due time to the chief ecclesiastical authorities of both confessions, with reference to the above-named decision, it was decided that the French orchestral pitch should also be used in the celebration of Divine service and for church music.

No objection whatever having hitherto been raised against the regulation in question, it may be assumed that the French pitch, which is especially calculated to prevent the overtaxing of the human voice, is at the present time universally in use in Bavaria.

The undersigned, believing that he has afforded the information requested in the note of February 19th of this year, avails himself, &c.,

(Signed) PRINCE HOHENLOHE.

Munich, April 16th, 1869.

A tuning-fork accompanies this reply.

DRESDEN.

(Translation.)

1. In Germany there is no officially prescribed musical pitch.

2. In a number of chapels and orchestras the new French pitch has been introduced; still, it may be assumed that they only comprise about one-sixth of all the chapels and orchestras of Germany, as very considerable expense would attend the acquisition of new wind instruments, were the French pitch generally adopted.

3. There was another reason, however not a financial one, for not introducing the French pitch. It appeared that the pitch adopted in Dresden was so slightly higher than the French pitch, that the difference would not warrant the outlay of something like 6,000 thalers (£900) for new wind instruments.

4. The new French pitch (diapason normal), fixed by the French Academy, is represented for A (La) by 870 vibrations; the pitch in the Royal Chapel at Dresden for A by 892 vibrations.

5. In the Roman Catholic Court Church of Dresden, the old so-called *chorus-tone* still exists, representing for A 855 vibrations. As a matter of course, different instruments are throughout used at the musical performances in the church. These are again sometimes made use of in the theatre for the production of Glück's music, and for some of Mozart's works, as in the time of Glück the vibrations for A were only 818, in the time of Mozart 850, and, by adopting the pitch of that period, the task is much easier for the singers, and does not injure the music.

DR. JULIUS REITZ,
Royal Saxon Chapelmaster.

A tuning-fork accompanies these replies.

STUTTGART.

Stuttgart, March 18, 1869.

MY LORD,—I have the honour to transmit herewith, in original and translation, the reply which I have received to the queries which your Lordship's instructions of February 12, in your Lordship's despatch No. 3, desire me to procure with reference to the standard musical pitch here, together with a tuning fork, showing the pitch usually adopted in Wurtemberg.

By the paper enclosed it will be perceived that there is no officially prescribed musical pitch in this country, although the new French pitch is that which is now commonly in use; and I have, therefore, so answered the question paper, also returned herewith, transmitted in your Lordship's despatch.

I have, &c.,
G. W. GORDON.

The Earl of Clarendon, K.G.

(Translation.)

Extract of Report from the Ministry of the Church and School Department regarding the Musical Pitch in Wurtemburg.

There is no special officially fixed pitch in Wurtemburg, nor, indeed, any particular one in use. But for the last few years, at the Royal Chapel and Opera, as also at all the German theatres and concerts of the first-class, the new French pitch, with 870 vibrations to A, has been introduced. This pitch may consequently be given as the usual one; it is in force in the Conservatorium and Stift's Church (the organ of which has been tuned thereto), and is used by piano, organ, and other musical instrument makers. A tuning fork can consequently be purchased from any of the first-class instrument makers, and, if necessary, can be compared with that of the Royal Chapel.

I am not aware that this pitch is introduced for military music, which is unnecessary, as there is no vocal music, and it would not be worth the cost of providing new instruments.

Private theatres and private concerts, as well as the town and church orchestras in Wurtemburg, still continue the old high pitch, either on account of the expense or of the difficulty of retuning the church organs.

The new French pitch can, therefore, be regarded as the one in general use in Wurtemburg, or even in Germany.

Stuttgart, March 6th, 1869.

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1. There is no officially prescribed standard musical pitch in Wurtemburg. But the new French pitch, with 870 single vibrations to A, has been introduced, and may be given as the usual one, being adopted in the Conservatoire, collegiate church, and used by pianoforte, organ, and other instrument makers.

A tuning-fork of this pitch is forwarded.

VIENNA.

(Translation.)

The Ministry for Foreign Affairs having made inquiries at the Ministry for Worship and Public Education, with regard to the questions put by Lord Bloomfield, &c., &c., on the 19th ultimo, on behalf of the Society for the Encouragement of Arts, Manufactures, and Commerce, concerning the musical pitch in Austria, has now the honour to make the following answers:—

1. In Austria there exists "an officially prescribed" pitch, only in so far that one has been introduced (and that the French standard pitch) in both the Imperial theatres, in the Court band, and in the more important concert societies in Vienna.

The French standard musical pitch is not based upon C (Ut), as the circular of the Society for the Encouragement of Arts presumes, but upon A, the altitude of which is fixed at 870 vibrations per second, and all the other notes are tuned up to this pitch.

In order to keep the real Paris pitch, tuning forks from Paris are procured for Vienna. It would be well if the above-named Society were to pursue the same course.

2. No "authority" in Austria has dictated a compulsory standard pitch, in the manner in which this was done in France when it became law that a standard musical pitch must be universally adopted in Paris, from 1st July, 1859; in the departments, at latest from the 1st of December, 1859.

The Lord High Chamberlain's office introduced the pitch of the Imperial theatres, and the Grand Master of the Ceremonies' office that for the Court music. The French standard pitch was introduced in these two establishments in 1862.

The Society of Friends of Music in the Austrian empire followed this example on their own account for their "conservatorium," as also did the Society of Philharmonic Concerts.

3. The standard pitch is only obligatory for the two Imperial theatres and the Imperial band of music. The remaining theatres in Vienna, and all the theatres in the provinces, are not Court or State establishments, neither is the "conservatorium" of the Society of Friends of Music. Therefore a measure of this sort, connected as it is with pecuniary sacrifices, could not be dictated to these establishments. Nevertheless the adoption of the French standard pitch by such establishments, is becoming every year more general.

The French standard pitch has not yet been introduced into the Austrian military band.

The undersigned avails himself, &c.,

(Signed) BIEGELEBEN.

GRAND DUCHY OF BADEN.

Carlsruhe, 30th April, 1869.

SIR,—Mr. Baillie, under date of the 20th of February last, desired information respecting the musical pitch in use in the Grand Duchy, and, for this purpose, forwarded to me a list of questions from the Society for the Encouragement of Arts, Manufactures, and Commerce.

I have now the honour of enclosing to you the answers to these questions, accompanied by a tuning-fork. I likewise enclose a report of the Court leader, Levi, assuming that his experience may be of service to the above-named Society. I may, likewise, remark that the Ministry of War informs me the Paris pitch is used by all the bands of the Baden troops, so that the blowing of the high instruments is lightened, and the tone of the music has gained in softness. It has, however, been noticed that the tuning-forks received from Paris do not agree in tone, and, therefore, they are compared to and kept in accordance with the pitch of the Grand Ducal Court orchestra.

I have, &c.,

(Signed) FREYDORF.

T. C. Cobbold, Esq.

(Copy.)

In returning the questions, I have the honour to remark as follows:—

1. The pitch officially used in France, and in most of the larger musical institutions of Germany, is the so-called "Paris;" the normal tone is A, with 870 vibrations in the second. I enclose herewith a carefully pitched tuning fork.

2. The normal pitch was introduced by an Imperial order from the French Ministry of the Interior, of February 16th, 1869, in all musical institutions, Imperial and other theatres in Paris and the departments, in schools, and musical conservatoires, on the opinion of a commission composed of the most scientific men in France, of composers, leaders of orchestras, and directors of theatres. The chief motive which guided the commission was the fact that the pitch had, in the course of time, reached an unnatural height, which threatened by a further increase to render the performance of older works impossible. In 1859, in the opera at Paris, A had 896 vibrations; in the Kärtner Thor Theatre at Vienna, 932, a height which fatigued the power to such an extent that it was soon used up, and necessitated a change and transposition of older musical works, thus prejudicing the intentions of the composers. An unofficial pitch has in itself a tendency in the course of time to rise; in Vienna, where the Paris pitch was introduced in 1862, it is said to have considerably risen. This is to be prevented, as is the case in the Baden Court theatres, by a comparison of the A of the instruments with the A of the normal tuning-fork.

3. The introduction of the normal pitch necessitates the purchasing of new wind instruments, and becomes, therefore, a question of money. Private orchestras, especially where the instruments belong to individuals and not to the company, have as yet avoided this expense; as, for instance, the Heidelberg, Freiburg, and Pforzheim choirs. The Paris pitch is, therefore, only obligatory when ordered by authority. As far as I know, it only exists in the Grand Duchy, at the Court theatres of Carlsruhe and Mannheim, and in the military bands. There are no longer any Royal choirs in the country. The pianos in the schools here are tuned to the normal A, as is also the case with pianos in private houses. The pianoforte makers (with the exception of those of Berlin, who, astonishing to say, are a tone higher) tune their instruments after the normal A.

(Signed) HERMANN LEVI.

Carlsruhe, 30th March, 1869.

BERLIN.

(Translation.)

1. There is neither an official normal pitch—that is to say, a pitch universally fixed—nor yet a pitch in common use, as the new Parisian orchestral pitch, which makes A with 437½* beats in the second, is only employed, up to the present time, at a few of the principal theatres and orchestras.

2. A congress of Parisian artistes—of which, indeed, Meyerbeer was a member—fixed it and introduced it. Any stage director or orchestra conductor could adopt this pitch if he thought proper, and was prepared to grant the expenses of procuring new instruments and altering the old ones.

3. This pitch is not obligatory, as, for instance, in Berlin, besides the new Parisian pitch, most of the chapels have still the former higher pitch. It has only been introduced at Berlin in the Royal opera-house, by the special command of the Intendant-General of the Royal Theatres. It is, however, to be expected that, by degrees, the Parisian pitch will become universal, as it offers special advantages to singers.

COLOGNE.

1. The Concert Society (*Conzertgesellschaft*) of Cologne adopted the French normal pitch several years since, and has procured the necessary instruments for the musicians. This pitch gives for the C 1,034$\frac{74}{125}$* beats in a second.

2. The same as the previous answer.

3. The new pitch is only obligatory for the representations of the Concert Society.

The Intendant-General of the Royal Theatres places at the service of the Society for the Encouragement of Arts, Manufactures, and Commerce, the accompanying tuning-fork, which gives A of the new pitch.

BARON VON HUBNER,
Intendant-General of Theatres.

Berlin, April, 1869.

NATIONAL SCHOOL FOR MUSIC.

The following petition, after special notice, was presented by the Right Hon. Sir J. Pakington, Bart., M.P., to the House of Commons, on Tuesday last, 20th July:—

TO THE RIGHT HONOURABLE THE COMMONS IN PARLIAMENT ASSEMBLED.

The Humble Petition of the Society for the Encouragement of Arts, Manufactures, and Commerce, London. Incorporated by Royal Charter,

SHEWETH—

That the Society appointed in the years 1866-7 a Committee, consisting of the following noblemen and gentlemen, to report on the Musical Education of the United Kingdom, namely:—Lord Gerald Fitzgerald; the Right Hon. Sir G. Clerk, Bart., Chairman of the Committee of Management of the Royal Academy; Sir J. E. Harington, Bart.; Sir J. P. Boileau, Bart.; Sir Francis Sandford; Messrs. W. Hawes, Robert K. Bowley, E. A. Bowring, C.B., Harry Chester, Henry Cole, C.B.; Capt. J. F. D. Donnelly, R.E.; J. Puttick, Samuel Redgrave; Lieut.-Col. Henry Scott, R.E.

That such Committee obtained full information of the constitution, present state, and working of the Royal Academy of Music, as well as evidence on the National College of Music, the London Academy of Music, and the London Vocal Academy. They received a report on the Military School of Music, Kneller Hall. On the subject

* Both these figures differ slightly from those usually given.—ED. *J. S. A.*

of Church Music the Committee entered into correspondence with the Deans and Chapters of the several Cathedral Churches. Through the Secretary of State for Foreign Affairs they obtained reports of the regulations of the several Musical Academies at Paris, Munich, Vienna, Prague, Leipsic, Milan, Naples, and Berlin.

That the Secretary of the Society of Arts was despatched to Brussels and Liège in order to report on the Musical Institutions there.

That in respect of the Royal Academy of Music, Sir George Clerk, Bart., Chairman of the Committee of Management, and Mr. Lucas, Principal of the Academy, gave complete evidence.

That the views of the musical profession were stated by the following gentlemen, who either appeared personally before the Committee or sent written observations:—Professor Sterndale Bennett, Mr. Benedict, Mr. Costa, M. Garcia, Mr. A. F. Godfrey, Mr. J. Hullah, Mr. Henry Leslie, Mr. C. Lucas, Mr. G. A. Macfarren, Sir F. Gore Ouseley, Mr. Ernst Pauer, Mr. Otto Goldschmidt, Mr. Turle, and Dr. Wylde.

That the Committee also received evidence and suggestions from Messrs. Capes, Harry Chester, H. F. Chorley, H. Cole, C.B., P. Le Neve Foster, and B. St. John B. Joule.

That the wide cultivation and use of music in this country, from the earliest period, especially before the dissolution of the Monasteries, appeared to the Committee to render it surperfluous for them to dwell on the importance and value of this important branch of the fine arts. They did not consider it within their province to enter upon the subject of the various systems of teaching music; but their inquiries were rather directed to ascertaining the principles and the nature of the administration by which the general musical education of the people of this country might be systematically conducted on a scale and with results at least equal to those of the Academies which flourish on the Continent of Europe.

That it appeared from the evidence that the Royal Academies of Music of Paris, Brussels, and Naples furnished instances of highly successful institutions, on an extensive scale, and presented especially useful suggestions. At Paris above six hundred out-door students, selected from all parts of France, are educated, and at Naples between two and three hundred students are trained. In both cases the education is gratuitous to the students, the expenses being paid by the State; at Brussels there are above 500 students, whose expenses are defrayed partly by the State, and partly by the municipalities.

That your petitioners submit that a national academy or musical training school, in connection with the education of the people, for the United Kingdom, its colonies and dependencies, is a public necessity, and, when created, should provide for the instruction of a certain number of students, supported by public funds, and a certain other number paying adequate fees. That certain students should receive gratuitous training, and that they should be selected by public competition.

That your petitioners respectfully submit to your Honourable House that a national musical training school can never be maintained by private enterprise, but only be established by the State, and be supported by public funds, disbursed under Parliamentary and ministerial authority.

That your petitioners are of opinion that as our colonies and India send many young persons to this country for general education, it might reasonably be expected that they would be induced to send persons having musical gifts for musical education if the facilities for training were as efficient as they might be.

That so far as your petitioners are enabled to judge from the evidence, they consider that at least two hundred free students should be trained, that they should receive grants for maintenance, at varying rates, in accordance with the system which is found to work so successfully in the Art Training Schools at South Kensington. That should Parliament see fit to create a proper and responsible musical training school in connection with public education, your petitioners have reason to believe that private individuals will come forward and endow scholarships.

That your petitioners consider that the only organisation which would appear to give hopes of adequate and permanent success is one which should be under proper ministerial responsibility and control. This the present constitution of the Royal Academy of Music does not provide. In support of this view your petitioners would refer to an "Appeal to Government and the Royal Commissioners of the Art Exhibitions in favour of a Government School of Music," signed by a very large number of the most eminent professional musicians of the day, and which has been printed and laid before Parliament.*

Your petitioners therefore pray that your Honourable House, as soon as circumstances appear favourable, will take the necessary measures for affording Musical Education to all classes of her Majesty's subjects in the United Kingdom, not less complete and efficient than is afforded by France, Germany, Italy, and other countries of Europe.

And your petitioners, as in duty bound, will ever pray, &c.

An Appeal to Government and the Royal Commissioners of the Art Exhibitions, in favour of a Government School of Music and National Opera.

Understanding that the Government and the Royal Commissioners of the Art Exhibitions are being petitioned to contribute still further to the maintenance of the institution called the Royal Academy of Music, we, the undersigned professional musicians residing in England, realising the fact that the Royal Academy of Music has failed to promote the highest interests of musical art, that the late Government grant has simply prolonged its existence but not extended its usefulness, and feeling, moreover, assured that any further repetition of such an attempt can only end in a similar failure, and prove equally discreditable to the country and wasteful of its funds, do hereby respectfully advise the establishment of a new school of music, in which every advantage may be offered to musical students, to be presided over by competent professors appointed by the State, and responsible to it for the efficiency of the institution. Connected with such an academy, we would further advise, if possible, the establishment of an English National Opera, believing by such agencies a genuine and useful impulse might be given to the development of musical genius in this country, ultimately redeeming it from the disgrace of being the only European nation that fails to cultivate its own national music.

Respectfully soliciting your consideration of our appeal, we remain, with great respect and consideration, &c.,

Therese Tietjens.	H. Wylde, Mus. Doc.
H. Lemmens-Sherrington.	Alfred Mellon.
J. Sims Reeves.	Ludwig Straus.
C. Santley.	Tom Hohler.
W. Harrison.	J. F. Barnett.
Rokitansky.	J. Pittman.
W. Ganz.	A. M. R. Barret.
G. Paque.	Rene Favarger.
F. Lablache.	W. Beavan.
R. Sidney Pratten.	H. Holmes.
T. H. Wright.	J. B. Ciabatta.
H. Handel Gear.	W. H. Hann.
E. Schubert.	F. Griesbach.
J. W. Thirlwall.	C. Harper.
V. Collins.	J. T. Carrodus.

And about 100 others.

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* A copy of this Appeal is appended.

FREE PUBLIC LIBRARIES AND MUSEUMS COMMITTEE.

CIRCULATION OF UNEXHIBITED SPECIMENS.

During the debate in the House of Commons on Monday, the 19th inst., on the Education Votes, Lord HENRY LENNOX, again referring to the above subject, observed that it had been said that the Society of Arts, of which he was Chairman of Council, interfered with everybody's business; but they only did so in matters in which they thought they could promote the moral and material welfare of the community. With regard to technical education, he thought there was nothing which tended so much to its development as national museums; and upon their good government, and being rendered accessible, depended in a great measure their success. Some weeks ago he wished to put a question to the government, having reference to the propriety of circulating works of art; he did not know to which minister to address himself, as there were four or five collections belonging to the Crown under as many different authorities, and accordingly he was obliged to put his question to the first Lord of the Treasury, fixing upon him the collective responsibility of the government. In putting that question he had been careful to intimate that he wished those objects of art to be circulated not only in Edinburgh and Dublin, but in Manchester and the other great hives of industry; and the right hon. gentleman, in answer, said that the government were anxious to do everything they could; that two collections of Turner drawings had been chosen, and would be established in Dublin and in Edinburgh. Establishment, however, was different from circulation; and, in his opinion, the great want of the present day was that the superfluities of the London collections should be circulated among the populous towns in the provinces. It was, therefore, with great regret that he perceived a reduction in one item connected with the very principle of circulation which he desired to see carried out; a vote which last year stood at £4,000 was this year reduced by £500. It was certain that the trustees of the British Museum were buying water-colours of Turner's, and storing them away in portfolios, while the trustees of the National Gallery were making up parcels to be sent to Dublin and Edinburgh; and what he wanted the Vice-President of the Council for Education to explain was, why there had been a decrease instead of an increase, in the manner contemplated by the member for Manchester. He trusted that some explanation would be given of the reason for the reduction of this vote, and that every facility would be afforded for the circulation throughout the provinces of duplicate works of art.

Mr. W. E. FORSTER, the Vice-President of the Committee of Council, in his reply, said he regretted that only £3,500 was to be spent in circulating articles from South Kensington. His right hon. friend the Chancellor of the Exchequer had felt obliged to request him to go carefully through all the votes of his Department, with the view of making them as economical as possible; but he believed that more would be done with the £3,500 than hon. gentlemen might expect.

Proceedings of Institutions.

EXAMINATION PAPERS, 1869.

The following are the Examination Papers set in the various subjects at the Final Examination held in April last:—

ARITHMETIC.

THREE HOURS ALLOWED.

1. How many casks, one of them holding $2\frac{1}{4}$ cwt., and the others each 7 cwt. 13 lbs., are required for 30 tons?

2. If 25 gross of pens are bought at 1s. 10d. a gross, and sold at 1s. 6d. a hundred, what profit is made?

3. A watch and chain are together worth £14 6s., the watch being worth £8 16s. more than the chain; find the worth of each.

4. Bought 3 cwt. of sugar at 36s. 6d. per cwt., and reserving some for private use, sold the rest at $4\frac{1}{2}$d. per lb. for the amount which the whole cost; how much was reserved for private use?

5. A sets out from a certain place, and walks at the rate of $3\frac{3}{4}$ miles an hour; B follows on horseback 20 minutes later, at the rate of $8\frac{1}{2}$ miles an hour; how soon will he overtake A?

6. What is the value of 18 gallons, 3 quarts, $1\frac{1}{2}$ pint, at 17s. $10\frac{1}{2}$d. per gallon?

7. Divide £6 1s. 11d. into three shares, so that the second share may be $\frac{4}{5}$ of the first, and the third $\frac{3}{5}$ of the second.

8. If $1\frac{3}{4}$ oz. of gold, 18 carats fine, be worth £5 11s. 5d., of what fineness must gold be in order that $6\frac{3}{4}$ dwts. of it may be worth £1 3s. $10\frac{1}{2}$d.

9. Suppose when 13 apples weigh 4 lbs., the cost of 5 dozen apples is 7s. 4d., what should 33 apples weigh when the cost of $4\frac{1}{2}$ dozen at the same price per lb. is 6s. 6d.

10. Express £1 4s. $10\frac{3}{4}$d. as the decimal of £3 19s. 8d.

11. Convert £246 13s. 10d. to francs, the course of exchange being 25 francs 18 cents per £.

12. If $8\frac{3}{4}$ lbs. of coffee, at 7 cents 2 mils. per lb., be equal in value to $4\frac{1}{2}$ lbs. of tea, what in decimal currency is the price of the tea per lb?

13. If the mercantile discount on a bill due in 5 months, at 4 per cent. per annum, be £1, for what sum was the bill drawn?

14. Express £195 6s. 3d. decimally in pounds, and then calculate on the result the difference between its simple and compound interest for 3 years at 4 per cent. per annum.

15. Which is the heavier, a pound of gold or a pound of feathers, an ounce of gold or an ounce of feathers; by how much in each case?

16. A certain number of apples were bought at four a penny, and an equal number at three a penny. The whole were sold at 7 for twopence. Required the gain or loss per cent.

17. What change of income is made by transferring £4,275 from the 4 per cents. at 80 to the $5\frac{1}{2}$ per cents. at 99?

18. If sugar can be bought at £3 14s. per cwt., how must it be sold to gain $12\frac{1}{2}$ per cent, after allowing a discount of $7\frac{1}{2}$ per cent.?

19. Four men can do a work in 1 hour, which two women can do in 3 hours, or six children in 2 hours. How long would 1 man, 1 woman, and 1 child take to do the work?

20. A piece of work can be done by A alone in 6 hours, by B alone in 5 hours, and by C alone in $4\frac{1}{2}$ hours. They all begin it together, but A only continues to work until it is finished, B leaving off 2 hours 10 minutes, and C $1\frac{1}{2}$ hour before its completion. In what time is the work accomplished?

THE METRIC SYSTEM.

THREE HOURS ALLOWED.

N.B.—Only six questions to be attempted.

Candidates may select their questions from either paper: the value of correct answers in the second paper being higher than that in the first.

FIRST OR EASY PAPER.

1. What is the fundamental unit in this system? Whence and why was it chosen?

2. Name the units of weight and capacity, and show how larger and smaller measures are obtained.

3. Give the English equivalents of a kilometre, kilogramme, and kilolitre.

4. Express the value of a mile, a ton, and a gallon in kilometres, kilogrammes, and litres.

5. How many cubic centimetres are contained in a cubic metre?

6. A vessel measures 2 feet square and 1 foot deep, how many litres will it contain?

SECOND OR MORE DIFFICULT PAPER.

7. Name those countries where the metric system is in general use, and urge any reasons for the general adoption of this system.

8. A room measures 10 metres each way and 4 metres high: what weight of air will it contain, in grammes?

9. A cistern is 2 metres long, 5 decimetres broad, and 8 centimetres deep. What is the exact quantity and weight of water it will contain?

10. A cubical block of ice measures 3 decimetres along its edge: what will be its weight, the specific gravity of ice being 0·94?

11. A cylindrical gasometer is 10 metres in diameter, and 15 metres high: what is its capacity expressed in litres and cbc? The volume of a cylinder $=\pi r^2 h$.

12. Explain how the units of weight, capacity, and surface have been obtained from the metre.

BOOK-KEEPING BY DOUBLE ENTRY.

THREE HOURS ALLOWED.

1. Journalise and post, in proper technical form and language, the following imaginary transactions, and make out from the ledger a trial balance, a profit and loss account, and a balance-sheet.

On 1st January, 1869, Grant and Ross have assets and liabilities as follows:—

ASSETS.

	£	s.	d.
Business premises, valued at	300	0	0
Cash at bankers	942	3	6
Petty cash	8	1	0
Acceptance of W. Thom, due 8th January	371	10	0
Due by A. Down	148	0	0
Goods on hand, viz.:—			
10 tons of tin	800	0	0
Wool	1,500	0	0

LIABILITIES.

T. Vane, balance of account	369	14	6
Our acceptance to J. Brook, due 18th Jan.	500	0	0

N.B.—The surplus assets over liabilities, being the capital of the business, belong to the partners in the following proportions, viz., to H. Grant, £2,400, to J. Ross, £800. The capital and drawings of the partners are subject to interest at 5 per cent. Ross, as manager, receives £25 a month. The remaining balance of profit and loss is divisible as follows:—To H. Grant, three-fourths; to J. Ross, one-fourth.

1869.		£	s.	d.
Jan.	1. Discounted W. Thom's acceptance, and received in cash £371, and allowed for discount 10s.	371	10	0
,,	4. Bought of T. Vane 5 tons of tin	400	0	0
,,	,, Accepted T. Vane's draft at two months	769	14	6
,,	6. Bought wool for cash	500	0	0
,,	8. Sold wool to W. Thom	1,000	0	0
,,	,, Received from W. Thom his acceptance for £500 at a month, and Harris and Co.'s acceptance to him for £500, due 31st January	1,000	0	0
,,	12. Received from R. Green consignment of indigo, invoiced at	1,200	0	0
,,	,, Accepted R. Green's draft at two months for	800	0	0
,,	14. Received cash of A. Down for balance of his account	145	0	0
,,	,, And allowed to him for discount	3	0	0
,,	15. H. Grant drew out for private expenses	50	0	0
,,	16. Sold for cash the whole of R. Green's consignment of indigo for	1,300	0	0
,,	,, Commission gained by us on the above consignment	33	0	0
,,	18. Renewed our acceptance, due this day, for £500 for two months, in favour of J. Brook (including interest)	508	12	0
,,	20. Cheque drawn for petty cash	20	0	0
,,	26. Sold 15 tons of tin to A. Down for	1,500	0	0
,,	,, Received from A. Down, cash	800	0	0
,,	,, ,, ,, his acceptance at one month for	700	0	0
,,	31. Received cash for Harris and Co.'s acceptance, due this day	500	0	0
,,	,, Paid J. Ross his salary as manager	25	0	0
,,	,, Paid salary of clerk	8	0	0
	Payment out of petty cash for trade charge in the month	15	1	0
	Interest on H. Grant's capital	10	0	0
	,, J. Ross's ,,	3	6	8
	,, H. Grant's drawing	0	2	4
	,, allowed to us by bankers on our balances during the month	4	0	6
	Interest due by us to R. Green	2	1	0
	Wear and tear of premises, estimated at	5	0	0
	Wool on hand, valued at	1,000	0	0

2. On examining the books it is discovered that the following transaction—"Interest allowed to us by bankers in the month, £4 6s."—has been posted as if it had been "Interest charged by bankers in the month, £4 6s." Give the journal entry or entries necessary to correct the error.

(To be continued.)

ECKHOLD'S OMNIMETER.

A new instrument, under this title, the invention* of a German engineer, M. Eckhold, has been brought out to aid in surveying operations, such as measuring the bases of triangulation, measuring distances either inclined or horizontal, measuring altitudes, and measuring angles. The omnimeter is calculated to effect an important improvement, combining, in one instrument, the theodolite and the level; doing away with the necessity for tedious chain measurements, and requiring in its operation no complicated calculations.

The instrument consists of the following parts:—1st, of a graduated circle, to read off each ten seconds in the measurement of horizontal angles; 2nd, of a powerful telescope, revolving in a plane perpendicular to the graduated circle; 3rd, of a microscope of high power, connected with the telescope and moving with it; 4th, of a highly sensitive level lying upon it; 5th, of a rule, or plane, having a fixed length (of twenty centimètres for example); 6th, of a scale fixed vertically at the extremity of the said rule, at a distance coincident with the optical axis of the microscope, which scale is divided into half millimètres (the millimètres are indicated by the numbers between 1 and 100); 7th, of a micrometrical screw movement connected with the base of the scale and giving the $\frac{2}{10000}$ of a millimètre of the scale, legible on the graduated circle beneath; 8th, of a second extremely sensitive level, capable of being applied to the telescope and of determining, in case of need, its horizontality; further, of all the necessary screws, keys, and other matters required to secure the efficient working of the instrument.

As the necessary complement of the omnimeter, there

* This description was furnished by the inventor.—ED. *J. S. A.*

is a levelling staff, not divided, but of an invariable length (as, for example, three metres), which length is defined by two white lines on a ground of black, one at the upper extremity and the other at the lower extremity of the staff.

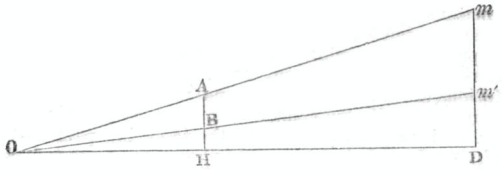
Before going into more ample details regarding the instrument, it may be as well, in order to show the way of working with it and the advantages to be obtained by its use, to take an example.

Supposing, then, that we require to ascertain the distance between any two points, the first thing is to place the levelling staff at one of the points (in this, as in all geodesical operations, the staff must of course be held in a true vertical position). We then take the omnimeter to the other point and set it up. By means of the level and its screw adjustment we place the instrument in a horizontal plane; then, directing the telescope upon the upper white line of the staff, we fix the telescope with the screw for that purpose; we read off on the scale, by means of the microscope, the inclination of the telescope. On account of the figures being magnified by the microscope, we shall be able to see only one number at a time of the 100 integrals of the scale; suppose we find the number 67 (millimètres) plus the unascertained fraction comprised between that number and the horizontal thread of the microscope. We ascertain the fraction exactly by means of the micrometer; say, in our example, that it reads as 2035 on the circle of the micrometer.

This we note down in our book to the right of the number 67 already obtained, thus..	672035
We repeat this operation in every particular for the lower line of the staff, and we obtain, say	609400
The operation with the instrument is now complete, as we are in possession of the data required for calculating the distances; let us take the difference between these two quantities.....	62635

And divide 6000000—a constant number for all cases—by the difference we have thus obtained and we shall have 95·79 m. as the horizontal distance in question. In fact, suppose the levelling staff in position at mm', let O be the point round which the telescope revolves, AB representing the difference as found = 62635.

From the point O let us draw a horizontal line; let us



produce the line AB to H, and the line mm' to D. We have then AB and mm' perpendicular to OD. In the similar triangles OAH and OmD we have the following proportion:—

$$\frac{OH}{AB} = \frac{OD}{mm'}, \text{ there } OD = \frac{OH \times mm'}{AB}$$

But

OH = 0·20m. (by the construction of the instrument).
mm' = 3·00m. (the invariable length of the staff).
AB = 62635 (the quantity obtained in our example by the scale).

The last quantity in fractions of the mètre is 0·002635m.; if we substitute for the letters their respective values, we have—

$$OD = \frac{0{\cdot}20\text{m.} \times 3}{0{\cdot}0062635\text{m.}} = \frac{0{\cdot}60\text{m.}}{0{\cdot}0062635\text{m.}} = \frac{6000000}{62635} = 95{\cdot}79\text{m.}$$

In the preceding example we have supposed the staff to be placed at one point and the omnimeter at the other. This manner of operating is not, however, the only one; there are two others, one by placing the omnimeter in line with the two points, the other by fixing it at some point outside. In either case, a staff must be set up at each of the points. In the first instance the total distance is obtained directly by adding together the back and fore sights. In the second instance we obtain the distance by measuring the horizontal angle, which we read off on the great circle, and by calculating the triangle (trigonometrically) by means of the angle thus obtained and the two sides.

For the establishment of a base of triangulation, the latter mode is that which we should recommend for adoption; for, if we proceed thus by small distances from 10 to 20 mètres on each side, or thereabouts, we may easily measure a base line of 1,000 mètres within an approximation of 0·004m.; a result which is quite satisfactory. In fact, if for a distance of 10 mètres, the scale gives us the difference 0·06m., it will give us for a distance equal to 9·99996m. the difference 0·0600002m., a quantity appreciable on the circle of the micrometer. The nature of this operation requiring extreme exactness, a staff of special construction should be employed. This staff would have the two faces similar to those already described; would be provided with supports to ensure its verticality, and, at its base, would be armed with a steel point and iron tressels. As regards the measurement of the slope or the inclined distance, the operation requires, further, the reading off of the horizontal line on the scale. We have then a new proportion:—

$$\frac{AB}{BH} = \frac{mm'}{m'D}, \text{ and } m'D = \frac{mm' \times BH}{AB},$$

Consequently,

$$Om' = \sqrt[2]{(m'D^2 + OD^2)}$$

General Observations.—The practice of the omnimeter has proved to us that in the measurement of lengths requiring extreme accuracy it is not prudent to make the points more than 200 mètres apart. At that distance we are within an approximation of 0·04m.; at 500 mètres, by making use of a staff 4 mètres high, the approximation will be within 0·17m.; a sufficiently satisfactory result, as, by one forward and one back sight, we can determine a kilomètre within 0·34m. With the chain we know, as a fact, that it is hardly possible to come nearer than within a mean of $\frac{1}{100}$ of difference.

In levelling, the operation is identical with that we have described for the measurement of inclined distances. The quantity is given by the formula—

$$m'D = \frac{mm' \times BH}{AB}$$

that is, three (mètres) multiplied by the difference of the sights, divided by the difference with the horizontal line.

The readings are obtained with the greatest precision. For distances not exceeding 100 mètres, they are obtained within a fraction of a millimètre; and for greater distances (at which the instruments at present in use are inoperative) the measurement can be obtained within a millimètre. This degree of precision is attained, because:

1. In placing the instrument, we have not to pay attention to centralising the optical axis.

2. Because the operator has always to point his telescope on the same lines of the staff, which lines denote an invariable length, viz., 3 mètres.

3. Because there can be no hesitation in reading the staff as with the ordinary levelling staves, with which we have an element of guess-work not found here.

In difficult and hilly ground, levelling with the ordinary level becomes a very long and very expensive operation, because the sights are necessarily short, and because the number of them is multiplied in proportion to the rapidity of the incline. The omnimeter, as may be perceived at once from the nature of the instrument, allows of levelling points placed at great distances apart, and which make considerable angles with the horizon.

Fine Arts.

ORDINARY EXPENDITURE IN FRANCE ON ACCOUNT OF FINE ARTS.—The budget of the Minister of Beaux Arts, for the year 1870, amounts to the sum of £486,064, being the same as that of the present year. The sum is made up of the following items:—Material expenses of the central administration, including heating, lighting, repairs of buildings, and furniture, £1,620; Imperial archives, £1,440; school of fine arts, £1,016. Cost of free schools of design:—Paris, £2,488; Lyons, £400; Dijon, £608; other localities, £480. Decoration of public monuments and establishments, and of religious edifices, £26,000. Purchase of works of art, and cost of casts, £7,200. Purchase and transport of marble for works of art, £2,600. Expenses of the annual exhibition of works of art in Paris (the whole of the receipts being devoted to the purchase of works exhibited in the salon, £12,200. Preservation of ancient historic monuments, £44,000. General council of public buildings:—Salaries and expenses, £4,132; maintenance of public buildings, £34,000; construction and repairs of public buildings, £56,000. The expenditure of the city of Paris for architectural and other works, schools, &c., is entirely independent of, and in addition to the above, which relates to the State alone.

Manufactures.

HEATING WINE.—The *Journal des Fabricants de Sucre*, quoted in the *Produce Markets' Review*, says: — M. Pasteur's plan of heating wine puts an end to the causes of disease or of change, by destroying in the wine the ferments, or the cryptogamic plants which produce them. For this, all that is necessary is to warm the liquid to a temperature of about 55° centigrade. The wine receives by this operation fixity and solidity of character, and it no longer contains the elements of change, which are completely eradicated by the heat. From these facts a new industry, that of warming wines, has sprung, and, indeed, has caused the question of the vinage, with which it has a certain analogy, to be rather overlooked. Several apparatus are in use for the heating process, which is carried on, on a large scale, and with great success, at Orleans, Béziers, and Narbonne. Steam or hot-water worms are used, but it is necessary to avoid exceeding a heat of 80° centigrade, and this condition is not easy of fulfilment either with steam or with boiling water. The apparatus employed hitherto have therefore a defective side—the difficulty of not passing the point at which the heating would become hurtful. It appears that wood spirit boils at 68°, and alcohol at 78°. Starting from these facts, M. Lallouel de Sourdeval has invented a wine-heating apparatus, composed of a small steam generator and alcohol evaporator, with a steam worm and an exhaust into the same boiler; and of a wine heater, containing a worm for the circulation of the alcohol, with a vessel above for the wine. The process is simple. The wine, introduced from below, runs into the heater, and runs off at the desired temperature by a waste pipe placed at the higher part of the receiver. The condensed alcoholic vapour runs back to the evaporator by means of a syphon placed at the bottom of the wine heater, which forms a reservoir, and is in communication with the evaporator. The apparatus is continuous and self-working; no steam of water or of alcohol is seen; the whole is in constant circulation without any loss, and without the least chance of accident or of getting out of order, and above all, with the impossibility of the heat exceeding 78°. This very ingenious apparatus is constructed to warm 100 hectolitres of wine in ten hours, at a very trifling expense.

Colonies.

REVENUE OF VICTORIA.—The following statement shows the estimated revenue for the colony for 1869:—

Customs	£1,335,000
Territorial	863,500
Income from public works	697,600
Postage	120,000
Fees	78,350
Excise	75,200
Miscellaneous	49,000
Ports and harbours	17,500
Fines and forfeitures	5,350
	£3,241,500

TELEGRAPHS IN VICTORIA.—A return relative to the electric telegraph offices has been laid upon the table of the House of Assembly. There are seventy-three offices throughout the colony, of which only four yielded a profit during last year; the remainder are carried on at an annual loss amounting from £3 4s. 4d., in the case of Coleraine, to £524 11s. 9d., in that of Inglewood. The stations which yield a profit are Ballarat, which paid £2,856 8s. 9d.; Belfast, £7 18s. 4d.; Geelong, £127 8s.; and Warrambool, £158 4s. Two stations were closed at the end of last year, and it is proposed to close those at Buningong, Carisbrook, Moonambell, Mornington, Newstead, and Seymour. The government have received guarantees for the payment of whatever loss may accrue in future at Coleraine, Penshurst, Walhalla, Serpentine, and Mansfield.

Correspondence.

ARTIFICIAL REFRIGERATION.

SIR,—My friend and agent in London, Mr. James, has been so obliging as to translate for me the lecture read by Dr. Paul, at the meeting of the Society of Arts, on the 16th December, 1868, as well as the remarks by which it was followed. I take the liberty of reviewing that essay, and of making some observations relative to my apparatus, and the relations which those of other inventors bear to it, whilst adding, as my contribution to the historical disquisition above-mentioned, some new facts.

I may be allowed, first of all, to make some remarks on the analogy which was pointed out between my latest inventions and Harrison's machine, which has subsequently been improved by Messrs. Siebe.

It is difficult, when various apparatus are intended to produce a similar result, to avoid finding in them some resemblances, but the differences must be taken note of at the same time. So far as I am concerned in this case, the latter exist as well in the refrigerating material as in the means employed, and also in the application and results. I should have been better able to admit the propriety of the comparison had Harrison been the discoverer of any principle; but he was no more than one of the links of the chain of inventors who have applied themselves to the problem of the production of cold. His machine, which has been recently improved in England by Messrs. Siebe, and previously had been improved in France by Mr. Reece and M. Carré, is the reproduction of a previous patent, omitted from mention in the interesting monogram of Dr. Paul, I mean that of the Englishman Shaw, who took out a patent in 1839, for the manufacture of ice by evaporation of sulphuric ether in a vacuum.

Now Shaw was not in any way the discoverer of a principle. The true discoverer was the illustrious Lesbie, whom I am always ready to recognise as a master, and to whom it is a gratification to be able to do homage. I render this homage with all the more pleasure, now that I am permitted to salute in his own country the

memory of a man who, by his genius, has become a fellow-citizen of every enlightened people.

I come now to the practical bearing of the question. I have remarked that, amongst the differences existing between my apparatus and those which have preceded it, the nature of the refrigerating material ought to be pointed out. I am the sole producer of that which I employ. Previous to my efforts it existed only as a curiosity in the laboratory. Discovered by M. Dumas, investigated by M. Peligot, it remained completely unused, and many chemists had never seen it, particularly in a liquified state. At this moment I can furnish it in quantities of more than 100 kilogrammes daily. I have delivered as much as 250 kilogrammes at once. I speak of methylic ether, an article which must henceforth take its place in the catalogue of refrigerating agents described by Dr. Paul. I think it will be interesting to point out some of its properties, which, for the most part, I have been the first to ascertain.

Methylic ether is gaseous at ordinary temperatures. It has an agreeable smell, like that of apples. It does not affect india-rubber joints, and has in general much less action on that substance than sulphuric ether. It does not perceptibly decompose oil; hence pistons continue properly lubricated, and friction is mild. It is very stable. Its manufacture is simple. In a gaseous state its specific gravity, taking air at 1, is 1·6; when liquified, its density, compared to that of water, is 0·714. Its expansion is as follows:—

Centigrades.		Fahrenheit.		Atmospheres.
—10°	..	(+ 14°)	..	2·25
— 5°	..	(+ 23°)	..	2·50
0°	..	(+ 32°)	..	2·75
+ 5°	..	(+ 41°)	..	3·25
10°	..	(+ 50°)	..	3·75
15°	..	(+ 59°)	..	4·25
20°	..	(+ 68°)	..	4·75
25°	..	(+ 77°)	..	5·
30°	..	(+ 86°)	..	5·25

An inspection of this table will show that these pressures are not extreme. The general properties of this body are so satisfactory, from the point of view with which we are at present occupied, that I do not hesitate to pronounce it the refrigerating material *par excellence*.

In certain cases, particularly in respect of navigation, where the term "ether" may be an obstacle to insurance, I substitute ammonia for methylic ether; but, on land, I have no hesitation in giving the preference to the latter substance, the manipulation of which is exceedingly easy. At this moment I am making an ice-machine, in which that substance will be employed to produce 2½ tons in twelve hours, a product truly remarkable, and without danger when the precautions necessary for all inflammable bodies are taken. It should be taken into consideration that, if methylic ether is inflammable, it is contained in metallic vessels of great resistance, prepared for and proved up to three times the pressure they are required to support. In such a state it not only presents no real danger, but is safer than most of the alcoholic matters which are moved about in barrels or bottles. The inflammability of methylic ether is, besides, so little to be apprehended that I use it as a test. When I wish to be assured of the tightness of an apparatus, I try all the joints with a lighted candle. If there is ever so slight an escape, a little flame appears, and a turn of a nut makes all safe.

This subject of pressure leads me to reply to some of the apprehensions expressed by Dr. Paul, as well as to establish the superiority of my apparatus over those which have preceded it. When five, six, or ten atmospheres are spoken of, the mind is appalled by the pressure thus indicated. An apprehension of this sort would be well-founded, if the diameters of the tubes in use were considerable; but the case is precisely the contrary, and thus, without giving any enormous thickness to them, I obtain considerable resistance. I am enabled, therefore, to test all the parts of ammonia machines at 40 atmospheres, and those where ether is used at 20 atmospheres. It will easily be seen that this arrangement is of the simplest, when it is known that in my small machines, which absorb 2,500 heat units per hour,* the cylinder of the compressing pump has a diameter of only five centimetres (two inches). In a still smaller size, which I am preparing for hospitals, country-houses, and sailing-ships, the cylinder, calculated to remove 500 heat units per hour, is only three centimetres in diameter (1½ inch). All the parts of my machines are established on these bases and proportions, and it will be admitted that there is absolutely no danger whatever in their use.

I now come to a more delicate point, the proof of the superiority of my machines over others. It is always unpleasant to me to be less courteous than I should desire to be towards my competitors and I lay it down as a rule that in competition the first duty of all is candour and respect. Not to transgress this line of conduct, I ask permission to treat the question generally, and without naming individuals.

In the front rank of the question lies that of refrigerating mixtures. The best, in my opinion, because there is no chemical change in the nature of the material employed, is the mixture of nitrate of ammonia and water, the combination of which produces considerable cold. But there is always a little nitrate lost in the process of reconstitution, whilst if a certain temperature (about 152° centig. = 305° Fahr.) is exceeded it is entirely decomposed. Ice made by this process costs, under the most economical conditions, 75 centimes (1s. 1½d.) the kilogramme. It is, therefore, impracticable.

The machinery acting by a vacuum comes next. It is precisely on account of the vacuum that the development of ice-making by this means is arrested. Nothing is so difficult to maintain as a vacuum; for confirmation of this statement I appeal to all natural philosophers. Nothing is less easily understood by workmen. Pressure is easily understood by them. If there is an escape it is seen at once; it yields to their efforts, they know how to obviate it. They cannot understand what a vacuum is. They do not perceive that the entrance of a little air should paralyse an apparatus. That is, however, so true, that unless the vacuum be completely maintained no progress is possible, and no ice obtained. I have been informed by one of the most intelligent manufacturers in France, who is a proprietor of a machine of this kind, that he has occasionally spent one week in the vain endeavour to discover the spot where a defect existed.

Leaving *terra firma*, let us for a moment proceed to sea. To speak of navigation in England is to treat the subject where it is best understood. Up to the present moment there has been hardly anything done in refrigeration as applied to the marine, and yet there are immense advantages to be obtained in that department —advantages which I have long applied myself to study, to work out in theory, and to make practicable. There is concerned, first of all, the transport of animal matters preserved by cold without any preparation. I think it useful here to recite the particulars given by Mr. Shand.

I preserved in September last (the experiments commenced about 15th of August) by cold alone, during nine weeks, fresh beef and mutton; during six weeks, game with entrails undrawn; during three and five weeks, fish not cleaned. I am convinced that more might have been done. First, because it was not any deterioration of the animal matters which led to a conclusion of the experiments, but because they lost their interest on the approach of cool weather. Secondly, because the apparatus was worked in an irregular manner, and because, under the conditions of continuity

* In England, the unit of heat is the quantity of heat required to raise the temperature of one pound of water one degree of Fahrenheit scale. In France, it is the quantity of heat which raises the temperature of one kilogramme of water one degree of centigrade scale.

presented by marine motive power, there is the means of having at all times the apparatus under command.

The particulars of the experiment are not uninteresting. On the two first Sundays of the period of the experiments the apparatus was not at work. There were then, on two occasions, 36 hours of cessation. The external temperature was, at the commencement, 28° centigrade (82° Fahr.). On the other Sundays there were only four hours during which the machine was worked, two in the morning and two in the evening. Every night, during nine weeks, the apparatus was at rest, and during the day there were only eight hours of movement. During some of the first nights, the temperature rose to 14° centigrade (25° Fahr.), in consequence of imperfect isolation. If we take account of numercus visits made to the apparatus, when the matters were taken out and handled, we can understand how much more efficient than the experiment should be a special undertaking, conducted under favourable circumstances.

At the present moment a steam-vessel, the *City of Rio de Janeiro*, has put to sea with the same apparatus which was at work in Paris. I am firmly convinced that this new experiment will lead to the result of bestowing on Europe the precious articles of consumption which are now lost on younger continents. It would be unjust not to mention here the name of the courageous man who has had the confidence to commence and continue this enterprise, M. Francisco Lecocq, of Monte Video.

M. Lecocq, without any knowledge of my process, took up the idea of applying cold to transoceanic movements. We were brought together by a common friend, and, by the aid of considerable capital (which I am bound to acknowledge M. Lecocq has not hesitated to employ in my processes), the result which I have just indicated is on the point of being attained. God grant that the experiment may succeed, by being preserved from the trifling accidents, which are nothing when an affair of this sort is reduced to practice, but which are everything when it is on trial. How many steps in the world's progress have been retarded by such causes. There is besides, however, every reason for entertaining such aspirations. This enterprise is of the nature of those which form the union of nationalities, giving wealth to some and abundance to others.

Such considerations will suffice, I trust, to secure the sympathies of the honourable Society of Arts, and I am sure they will accompany M. Lecocq in his bold and generous attempt.

I pass from the commercial question to another, that of the comfort of passengers during distant voyages. It is not possible to obtain ice everywhere; it is often expensive; it is always difficult to keep it. My apparatus remedy these inconveniences. With them, and a little power supplied, every steamer might not only keep its own provisions fresh, but supply its passengers with ice in abundance.

The Compagnie Générale Transatlantique has at present under consideration the adoption of my apparatus on board the steamers intended for their Pacific line. I hope that very soon my efforts will be appreciated in England, and that the steam navigation companies will comprehend the economy and other advantages which my processes afford. I am concerned not only with the comfort of the passengers and of the officers, but with the health and general welfare of the seamen who man our commercial fleets.

Ice, in case of sickness, becomes an energetic remedy. I expect to be able to furnish an apparatus which can be worked by hand. Such machines are now in progress, but that is not all. Ordinarily, and particularly on board steamers, distilled water is supplied to the crews. This water cannot, in warm latitudes, be sufficiently cooled. Its solvent properties are less than those of other water, it contains less air, and is consequently unwholesome. With my apparatus, for 10 to 15 centimes the hectolitre (4d. to 7d. the 100 gallons) in all latitudes, the temperature of water may be reduced from 40° to 15° centigrade (100° to 60° Fahr.), the latter being that best suited for deglutition.

Then there is still the ventilation by cooled air of holds, cabins, etc., etc., matters to which I have long given my attention, and which I hope soon to see in actual practice.

It is not by machines dependent upon the production of a vacuum that these results will be obtained. Besides being cumbrous, how could a defect be discovered in the midst of the noise of the engines, the shocks of the waves, the whistling of the wind, or the roar of the tempest? Neither will it be by compressed air that the results can be attained. To abandon the energetic absorption of caloric produced by evaporation for that which is effected by the dilatation of the air alone, can never be an economical procedure.

Nor will apparatus employing ammonia and water be efficient. That such apparatus is difficult to manage on land I know by my own experience, since I was the first inventor of it; and, according to reports I receive daily, it is impossible at sea, where the movements are opposed to every efficient separation of the products of the operation. In short, my apparatus alone remains applicable to such circumstances, and I confess it is this idea which has for long governed all my researches relative to the production of cold.

I have only to add, in completion of this part of my subject, some words in respect of Reece's apparatus, and of another mode, suggested, I believe, in Australia, the transport of liquified ammonia, and its utilisation in case of need.

The first of these methods, that of Mr. Reece, is only, it must be acknowledged, a simple improvement of the apparatus sold under the name of M. Carré. I am not aware whether Mr. Reece is a European, but if he is not, and has not come to an arrangement with Messrs. Carré and Co., I should recommend him strongly, before introducing his apparatus into Europe, to consult the documents relative to my lawsuit with Messrs. Carré and Co. I shall be happy to communicate them to him.

The second method has been proposed for, *I believe*, some twelve or eighteen months. It was described by me in one of my patents, dated five or six years back, and is detailed at length in my work on ammonia, entitled "L'Ammoniaque dans l'Industrie," Paris, 1866. I am bound to say at once that it is not applicable to maritime transport. A few figures will prove this. If we consider that the temperature of 0° centigrade (32° Fahr.) must always be maintained; that a very considerable quantity of heat passes through the walls whatever method of insulation may be used; if we remember, first, that the store ammonia metal vessels, heavy and cumbrous, weighing at least, for safety, four times the contents, must be provided; secondly, that to collect its vapour there is needed at least four times its weight of water, besides that of the recipient vessels, lighter indeed, but still heavy, we shall arrive at this conclusion, that one kilogramme of ammonia, giving five kilogrammes of ice, will require a dead weight of nine kilogrammes; that is to say, 1 kilogramme of ammonia + 9 kilogrammes dead weight, making 10 kilogrammes, for 5 kilogrammes of ice, or 2 kilogrammes dead weight for 1 kilogramme of ice, whilst, with my apparatus, 2 kilogrammes of coal give a minimum of 15 kilogrammes of ice.

The weight of my apparatus representing barely that of the water-tanks of ammoniacal water, which I have purposely neglected above, we arrive at this proportion, that with prepared ammonia, one kilo. of dead weight will give 0·500 grammes of ice, whilst with my apparatus 1 kilo. of dead weight will give 7 *kilos. 500 grammes*, that is to say, in the proportion of one to 15 in my favour, which places beyond discussion the superiority of my latest processes.

In respect of railway carriage and the preservation of fish on board fishing-boats, the situation is different. But I have long ago indicated this method. It is true, and I

say it with regret, I have long preached in the desert. I hope this state of things will not exist much longer, and I rejoice in the development given to this question of refrigeration by the Society of Arts. I am confident that the interest it has so warmly testified, and the intelligent appreciation of the bulk of its members, will aid in developing methods which our children will daily make use of without being able to comprehend how we have been so slow in adopting them.

The chairman of the meeting, on the 16th December, expressed his regret that positive information was not supplied as to the production of cold by these machines; I am able to inform him on that subject. The machine which I have furnished to the Compagnie des Salines du Midi withdraws 10,000 heat units (French heat units) per hour, as ascertained by dynamometer, its required $5\frac{1}{2}$ horse-power of 75 kilogramètres. This proportion is 1,810 heat units per horse-power.

I allow a mean of 100 heat units per kilogramme of ice. I obtain this estimate as follows:—I suppose the water at a mean temperature of 20·75° centigrade. I add to this, for latent heat, 79·25; and I obtain 100° in round numbers, which I take for the mean equivalent of ice in all countries. The machine can therefore furnish 18 kilos. 100 grs. of ice per horse-power per hour. I admit in practice only 15 kilogrammes, and I am ready to guarantee this figure whenever it may be necessary. Allowing two kilogrammes of coals to be expended per horse-power per hour, the same calculation will bring us to 11 kilos. for 10,000 heat units, equal to 1 kilo. 100 grs. of ice or $1\frac{1}{10}$ ton of coals per 10 tons of ice.

On a large scale, with machinery consuming $1\frac{1}{2}$ kilos. per hour, 10 tons of ice will require less than 1 ton of coals.

It is time to conclude. I have perhaps abused the attention given me, but I cannot conclude these observations without offering my thanks to the Society of Arts for the attention it has bestowed on my endeavours. I owe my best thanks also to Dr. Paul, for the favourable remarks he made on the same subject.

I feel flattered at having been, during some moments, the object of the attention of a meeting so eminent as that of the Society of Arts, and remain, &c.,

CH. TELLIER, C.E.

21, Rue Boulainvilliers, à Passy, Paris.

Patents.

From Commissioners of Patents' Journal, July 16.

GRANTS OF PROVISIONAL PROTECTION.

Agricultural implements—1977—A. Walker.
Anæsthesia, producing partial or complete—2046—A. P. Price.
Barges, &c.—2013—T. Grahame.
Bar iron, &c., manufacturing—2026—W. E. Newton.
Billiard and bagatelle room convenience—1993—H. A. Bonneville.
Biscuits—2015—G. Palmer.
Bobbin net or twist lace machinery, apparatus applicable to—1964—H. Yates.
Boilers, feeding—2019—J. Clark and A. Ewing.
Boots and shoes—2010—N. Mole.
Carding engines, &c., cards used in—2040—J. Shore.
Carding machinery—1997—S. Brooke.
Carriage springs—1969—W. E. Gedge.
Chairs for travellers—2030—J. Gedge.
Chandeliers—2052—A. V. Newton.
Colouring matters—1948—W. H. Perkin.
Corks—1999—C. D. Abel.
Croquet markers—1987—L. F. Banks.
Crushing machinery—2014—I. James.
Fabrics, looped or knitted—1991—E. Roe.
Fire-arms, breech-loading—1985—J. H. Johnson.
Fire-arms, breech-loading—2025—L. Falisse.
Furnaces—1981—R. Porter.
Galvanic batteries—2003—J. Smithers.
Glass, &c., ornamental articles in—2004—W. A. Biddell and J. Redgrave.
India-rubber, utilising waste strips of—1989—A. Turner.
Knives for reaping and pruning—1930—R. Olpherts.
Lace—2017—T. Butler and R. F. Carey.
Lifting apparatus—1183—P. Bogler and H. Kayser.
Liquid meters—2006—H. E. Newton.
Liquids, registering the flow of—2038—W. Q. East.
Lubricators—1919—O. Zabel.
Lubricators—2033—W. L. Wise.
Meat, preserving—2054—J. H. Johnson.
Metallic boxes, &c.—1967—M. Turnor.
Metallic lead, &c., producing—2034—C. Crockford.
Motive-power engines—1249—G. White.
Motive-power engines, &c.—2032—W. Walker.
Nail-drawing implements—2018—C. Churchill.
Oil, manufacturing from castor and other oleaginous seeds or berries—2012—A. H. A. Durant.
Photographs, transferring to wood and other surfaces—2022—F. W Grüne.
Pianofortes—2007—J. Steward.
Pipes or tubes, jointing—1979—R. W. Whitehead.
Printing surfaces, producing—1965—R. H. Courtenay.
Puddling furnaces—2050—W. E. Newton.
Puddling furnaces, &c.—2001—W. Frazer.
Railroad cars, &c., springs for—2009—P. G. Gardiner.
Railway tickets, apparatus for regulating the delivery of—1185—P. Bogler and H. Kayser.
Refrigerators 2037—W. Bray.
Sewage, utilising, &c.—2016—J. Hart.
Stays, &c., busks for—2042—H. E. Knight.
Steam engines—1971—D. Hebson.
Steam engines—1998—G. White.
Stop-cocks or valves—1557—Z. E. Coffin.
Switches and signals—1975—R. Boyd.
Taps—2021—W. Duckworth, jun.
Taps—2036—L. and L. Clayton and J. Smith.
Telegraphic cables—2008—A. Foucaut.
Terry fabrics, weaving plain and elastic—2009—H. Turner, jun.
Travelling bag and chair combined—2002—W. R. Lake.
Type composing and distributing machines—2031—C. D. Abel.
Varnishes—1947—T. Gray.
Vehicles, &c., four-wheeled—2027—J. Knight.
Velocipedes—2023—T. Wilson.
Velocipedes, &c.—2044—J. B. Rogers.
Walking sticks, &c.—1888—J. B. Brooks and G. Picken.
Water-closets, &c.—1973—R. Heyworth.
Water-heating apparatus—2035—C. E. Brooman.
Waterproof varnishes and paints—1927—J. Macintosh.
Wood, machinery for cutting, &c.—2029—W. B. Haigh.

INVENTIONS WITH COMPLETE SPECIFICATIONS FILED.

Coal, &c., compressing and moulding small—2045—V. A. Deaubeuf.
Gas—2103—C. F. Dunderdale.
Steam engines, &c., slide valves of—2106—J. Piret.
Velocipedes—2048—F. Trappes.

PATENTS SEALED.

157. P. Oldfield.
165. H. and J. Parnall.
167. S. G. Archibald.
169. G. Lowry.
170. W. and J. Pain.
172. J. Armstrong.
178. J. Siddeley & F.N.Mackay.
179. F. A. Paget.
184. P. C. Evans and H. J. H. King.
199. W. R. Lake.
210. W. E. Gedge.
213. J. Beattie.
217. W. Huggins and H. Hornsall.
215. J. Ortton.
233. R. J. Green.
259. J. Silman.
277. W. MacLean.
287. F. Jay.
299. J. Tolson.
311. C. Hoult.
315. D. Joy.
372. J. C. Shaw.
462. C. W. Lancaster.
715. I. Hudson.
1214. M. Andrew.
1479. C. W. Lancaster.
1647. W. R. Lake.
1682. W. R. Lake.

From Commissioners of Patents' Journal, July 20.

PATENTS SEALED.

203. M. Tildesley.
219. H. H. Murdoch.
220. B. Mountain, T. Richmond, and G. Duffield.
232. H. D. Bowyer.
237. E. D. Ruston and W. W. Mills.
238. J. D. Ellis.
242. J. Pickering.
283. G. Price.
308. A. V. Newton.
329. A. S. and A. R. Stocker.
348. J. Vavasseur.
349. E. Morewood.
362. J. Halford.
383. R. W. Row.
401. G. F. G. Desvignes.
404. J. H. Johnson.
442. W. E. Newton.
582. B. P. Walker.
620. R. J. Goodbody and R. E. Donovan.
887. F. de Bowens.
942. E. Morewood.
988. J. B. Rowcliffe.
1119. J. Easton.
1292. W. Prowett.
1317. A. Meredith.
1369. T. Perkins.
1394. I. and G. Battinson and T. Whitehead.
1427. W. E. Newton.
1510. W. R. Lake.
1567. W. R. Lake.
1577. W. R. Lake.
1613. W. Palliser.
1649. T. Clarke.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

1979. W. Beaumont and Wm. McMaster.
2146. J. Whitworth.
1915. G. Mountford and G. L. Loversidge.
2325. E. Fitzhenry.
1861. W. Thompson.
1874. N. Salamon.
1936. G. B. Woodruff.
1868. G. Plant.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

2027. R. Ridley and J. G. Jones.
2042. R. Dunn.
2088. T. King.
2096. A. Vignon.
2057. C. A. Day and T. Summers.
2060. R. Barrett.